P14 - BACTERICIDAL ACTIVITY OF SURFACES COATED WITH NITROGEN-DOPED TITANIUM DIOXIDE UNDER DIFFERENT LIGHT SOURCES

D. Rodrigues[1], P. Teixeira[1], R. Oliveira[1], C.J Tavares[2], J. Azeredo[1]

[1]Institute for Biotechnology and Bioengineering, Centre of Biological Engineering, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal

[2] Physics Department, University of Minho, Campus de Azurém, 4800-058 Guimarães, Portugal

jazeredo@deb.uminho.pt

Abstract

Since the microbiocidal effect of titanium dioxide (TiO_2) photocatalytic reactions was reported for the first time in 1985, several works have been done regarding TiO_2 photocatalytic elimination of a wide spectrum of organisms, including bacteria (*Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa, Salmonella* spp., etc.), fungi (*Candida albicans, Aspergillus niger*, etc.), algae and cancer cells. Although TiO_2 photocatalyst is effective only upon irradiation by ultraviolet (UV) light at levels that would induce serious damage to human cells, the emergence of nitrogen-doped TiO_2 (N-TiO_2) brought a significant improvement in photocatalytic activity under visible-light, offering the potential to develop TiO_2-coated surfaces for use in our living environments. Such surfaces are of particular interest in places were disinfection plays a crucial role in the prevention of infectious diseases, such as hospitals, microbiological laboratories, pharmaceutical industry and, our area of interest, food-processing environments. In this context, the aim of our work was to evaluate the bactericidal effect of N-TiO_2 coated materials under both visible and UV light to infer about a possible application of this surface treatment on food-contact surfaces. All assays were performed in aseptic conditions using a clinical isolate of *Listeria monocytogenes* (*L. monocytogenes*)

and coupons of two materials used in kitchens - glass and stainless steel – both coated with N-TiO_2 and subjected to heat treatment at 500ºC. The different light sources consisted on two fluorescent lamps of 4 W each, one incandescent lamp of 60 W and two UV lamps, which light intensities were respectively 0,13 mW/cm^2; 8,93 mW/cm^2 and 0,83 mW/cm^2. After covering each coupon's surface with a well known number of bacterial cells in suspension, the photocatalytic reactions took place at room temperature for 30 minutes. All the remaining suspension on the coupons was collected and the number of viable cells assessed by colony forming units enumeration. Results showed that all light sources were able to reduce the number of bacteria cells on both materials coated with N-TiO_2, when compared with the controls (uncoated surfaces), except for glass coupons when exposed to the fluorescent light. Nevertheless, a logarithmic reduction of the bacterial load on both materials was only achieved with the UV-light which means that, although the N-TiO_2 coating applied in the tested surfaces was able to endorse some bactericidal activity on *L. monocytogenes* under visible light, it was the UV-light the one that lead to the most efficient photocatalytic reaction. This allows us to conclude that such surface treatment on glass and stainless steel could be applied in food-processing environments, in order to improve hygiene conditions and disinfection, but only if conveniently complemented with careful sanitation procedures (as for example exposure to UV-light whenever possible) to ensure total food safety.

Notes